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Growth performance of broilers raised under mango plantation fed different levels of crude protein

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Abstract

The study was conducted to establish data on the level of Crude Protein that is required by broilers and to determine their growth performance and carcass quality when raised under mango plantation fed different levels of crude protein in their diet. One hundred fifty two-week old commercial broilers white strain (Cobb 500) were used and distributed equally to the following treatments: T_1- 21%CP, T_2- 20%CP, T_3-19%CP, T_4- 18%CP, and T_5-17%CP. These were laid out in Complete Randomized Design with three replications. The birds were fed in restriction for a period of five weeks. Feeds were withdrawn from the birds daily when they are in range, 3 hours in the morning and 3 hours in the afternoon. Results showed that T_3 significantly differed with T_4 and T_5 but not with T_1 and T_2 with a feed conversion ratio of 2.0 and T_1 obtained the lowest percentage abdominal fat deposition with 0.74. In terms of profitability, T_3 had the best return above feed cost with P178.01 income per chicken. This study revealed that feeding the ranged broilers with 19% CP resulted in better feed efficiency, and income, while 21% CP obtained the least fat deposition.

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Introduction

Organic poultry production is now the trend; most farmers prefer this type of raising flocks, because of its economic advantages, low investment needed, minimal labor, and low costs of production (ATTRA, 1999). They also believed that birds ranged in forage pasture are healthier, more nutritious and better tasting meat compared to indoor poultry meat, this is because their exposure to natural environment. In addition to this, the birds get their natural sources of their food like vitamins, protein, and minerals usually in the guise of insects and worms, seeds and forage grasses in the range area. Free-range birds are able to acquire their supplemental foods about 50 percent from the natural vegetation and the rest of which come from supplemented feed grains.

Studies have also revealed that there are substantial increases in nutritional value of pastured poultry, particularly in Omega-3, Fatty Acids and Vitamin A, and a significant decrease in total fat, which makes it a better food. Moreover, the meat produced from organically grown poultry generally commands higher demands and price (Lee, 2001). More importantly, health conscious consumers prefer organically grown chickens than commercial broilers due to its less cholesterol and fat content from the meat and table egg.

Considering these perceptions it is necessary to formulate rations that are more economical considering the nutrient requirements that will be applicable to range chickens which will result to its optimum growth performance. One of the critical nutrient in the formulation is the amount of Crude Protein in their diet, an increase and decrease of this nutrient will have an effect on its performance.

The feed for these animals should be complete and balanced ration of more or less organically produced agricultural products, including forage and pasture. In their feed ration, raisers are still using the nutrient requirement standards for confined commercially grown chickens as their basis e.g. Crude Protein (CP), Metabolizable Energy (ME) and other needed nutrients. It is on this premise that this study is conducted to establish data on the level of Crude Protein that is required by broilers grown in range. Feeding different levels of crude protein diet will help determine the efficiency of commercial broiler chickens when raised under free-range or organic production systems. The study aims determine the effect of different levels of crude protein in terms of body weight gain, rate of growth, feed consumption, feed conversion efficiency fat deposition and return above feed cost. It will also determine the crude protein level of the formulated ration that is best suited for broiler production under range in terms of return above the feed cost.

Materials and methods

One hundred fifty (150) commercial broiler white strain (Cobb 500) 14-day old chicks were randomly distributed to five treatments with 10 broilers per replicate. The birds were fed with 5 different Crude Protein levels described as follows Treatment 1- 21% CP, Treatment 2 20% CP, Treatment 3 19% CP, Treatment 4 18% CP and Treatment 5 17% CP. The treatment formulations were offered using automatic type tube feeder. The birds were not given feed ration when they were in the range.

The birds were ranged in a prepared area under mango orchard planted with carabao grass. The grasses were uniformly trimmed at least 21 days before the birds were transferred to their respective ranging areas. The birds were allowed to range under the mango plantation three (3) hours in the morning and three hours in the afternoon after brooding until 7^{th} week of age. They were brought out from their rearing house at 6:00 am and were flocked back at 9:00 am. The birds were again brought out to range at 3:00 pm to 6:00 pm after which they are withdrawn and put in their respective shelters until the next day.

A tent type rearing house made up of laminated sack with a dimension of 1.0m x 1.5m was constructed for each replication. Each bird is provided with $4m^2$ of range area with a total of 600 m^2. The broiler chickens were fed with the following ingredients:

yellow corn, rice bran, soybean oil meal, coco oil, limestone, Tricaphos DL-methionine, L-lysine, vitamin premix and salt. The different treatment formulations were computed based on the nutrient composition of each ingredient. All the ingredients were weighed individually based on the amounts calculated in the formulation and were mixed manually by the use of shovel on concrete smooth flooring. Composition and calculated nutrient analysis of the different diets are presented in Table 1.

Data gathered and statistical analysis

The performance of the broiler chickens in the different treatment groups were evaluated based on average weight gain, feed consumption, feed conversion ratio. The carcass quality was determined by the percentage abdominal fat deposition. The income over feed cost and broiler chicken cost analysis were estimated to determine the economic profitability. All data gathered were subjected to Analysis of Variance (ANOVA) using MEGASTAT (version 10.4) following a Completely Randomized Design (CRD). Significant differences among treatment means were compared using Least Significant Difference (LSD).

Results and discussion

Initial and Final Body Weight

The initial and weekly body weight of ranged broilers under mango plantation is presented in Table 2. The initial body weight of the birds ranged from 220 to 240 grams while its final body weight was 2110 to 2436.67 grams.

Table 1. Calculated nutrient composition of formulated diets fed to broilers with different Crude Protein levels under mango plantation.

Composition	T1	T2	T3	T4	T5
Corn	56.00	59.82	60.20	61.55	63.10
Rice Bran D1	9.810	8.10	10.05	11.63	12.89
Soybean Oil Meal	25.85	25.20	23.20	19.90	17.50
Fish Meal	4.950	3.40	3.00	3.200	3.0
Coco oil	0.800	0.50	.045	0.500	.200
DL-Methionine	.0.040	0.070	0.080	0.090	0.100
L-Lysine	-	0.090	0.170	0.250	0.300
Limestone	0.550	0.550	0.550	0.600	0.560
DicaPhos	1.450	1.720	1.75	1.730	1.800
Salt	0.250	0.250	0.250	0.250	0.250
Vit/Min Premix	0.300	0.300	0.300	0.300	0.300
Total (%)	100.00	100.00	100.00	100.00	100.00
Calculated composition					
Crude Protein (%)	21.10	20.00	19.12	18.06	17.12
Metabolizable Energy (Kcal)	2933.08	2938.27	2935.73	2948.62	2940.91
Calcium (%)	0.85	0.86	0.85	0.860	0.850
Available (%)Phosphorus	0.50	0.50	0.50	0.50	0.50
Methionine (%)	0.39	0.40	0.39	0.39	0.39
Lysine (%)	1.03	1.02	1.02	1.02	1.01

Total Gain in Weight

Based on the results obtained, T_3 recorded the highest total weight gain of - 2208.30 grams, T_1- 2140.00 grams, T_2- 2126.68 grams, T_4- 2055.00 and T_5 - 890.01 grams, respectively. However, analysis of variance showed no significant differences among treatments. This means that the level of Crude Protein of the diet from 17% to 21% did not affect the gain in weight of the experimental birds. Although not significant, there was a reason to believe that low

level of protein could depress growth which was shown by the performance of treatment 5 (17% CP) 1890.01 grams which got the lowest weight gain. This finding is in accordance to the study of Bikker *et al.* (1994) that protein deficiency in a feed reduces growth as a result of depressed appetite and intake of nutrients. In contrary, Bartezcko (2008) in his study found that broiler chickens fed mixtures with higher protein content (23%) obtained higher body weight gain in comparison with broilers fed a diet with 19% content of protein.

Table 2. Average cumulative performance of broilers raised under mango plantation fed different levels of crude protein.

Performance Parameter	Treatment(Crude Protein Levels)					
	1	2	3	4	5	CV%
Initial Wt.	233.33	240.00	228.33	235.00	220.00	7.10
Total Weight Gain	2140.00	2126.68	2208.30	2055.00	1890.01	7.26
Total Feed Consumption	4550.00	4463.34	4438.32	4513.34	4336.51	4.73
Feed conversion Ratio*	2.13^{bc}	2.10^{bc}	2.00^{c}	2.20^{ab}	2.30^{a}	3.59

*Means in the same row with different superscripts are significantly different (P<0.01).

Feed consumption

The total feed consumption of the birds fed with the different levels of crude protein showed that T_1 (21% CP) consumed 4550.00 grams, T_4 (18%CP) 4513.34 grams, T_2 (20% CP) 4463.34 grams, T_3 (19% CP) 4436.32 grams, and T_5 (17 % CP) with 4336.51 grams. However, analysis of the data did not reveal any significant differences on the total consumption of the experimental birds. This finding is in accordance with Ferguson *et al.*, 1998; Araújo, 2001; Faria *et al.* (2011) that crude protein levels had no effect on feed intake; nevertheless, body weight gain and feed conversion were impaired with decreasing protein levels in the diet. Similar results have been observed by Hussein *et al.* (2001) and Bregendahl *et al.* (2002), reported decreased performance of birds fed with low-protein diets. Gonzales (2002) stated that the diet intake control is affected not only by the protein content, but also by the protein quality, *i.e.*, amino acid balance.

Table 3. Abdominal fat deposition of broilers raised under mango plantation fed with different levels of prude protein.

Treatments	Fat deposition (%)
T1 - 21% CP	0.74d
T2 - 20% CP	1.34bc
T3 - 19% CP	1.00cd
T4 - 18% CP	2.04a
T5 – 17% CP	1.47b
C.V.(%)	24.19
$LSD_{0.05}$	0.34

*Means in the same row with different superscripts are significantly different (P<0.01).

Feed Conversion Ratio

The feed conversion ratio varied among treatments. Treatment 3 had better efficiency in converting feeds into meat than the other treatments. Treatment 3 (19% CP) had an FCR with 2.0 followed by T_2 (20% CP) with 2.10, T_1 (21% CP) with 2.13, T_4 (18% CP) with 2.20, and T_5 (17% CP) with 2.30. Analysis of variance showed significant differences among treatments at 1% level of significance. Comparison among means showed that T_3 (19%CP) significantly

differed with T_4 (18%CP Control) and T_5 (17% CP) but not with T_1 and T_2. Likewise T_1 and T_2 differed with T_5 but not with T4.This finding is in accordance with Faria *et al.* (2011) that feed conversion was impaired with decreasing protein levels in the diet.

Abdominal Fat Deposition

The weight of fat deposited in the abdomen of broilers fed with different levels of crude protein is presented in Table 3.The fat deposited at the abdomen of the broilers fed with different levels of protein ranged from 0.74 to 2.04%. Birds fed with 21% CP obtained the least fat deposition with a weight of 0.74%, followed by Treatment 3 (19% CP) with 1.0%, treatment 2 (20%CP) with 1.34%, Treatment 5 (17% CP)with 1.45% and Treatment 4 with 2.04%.Analysis of data revealed significant differences among treatments tested.

Table 4. Return Above Feed Cost of Birds Fed With Different Levels of Crude Protein Under Mango Plantation.

	Treatments				
Item	$T1_{21\%\ CP}$	$T2_{20\%CP}$	$T3_{19\%CP}$	$T4_{18\%CP}$	$T5_{17\%CP}$
Cost					
Cost/kg feed	20.64	20.11	19.60	19.04	18.43
Total Cost/Treatment	2817.36	2962.72	2609.74	2578.01	2397.74
Total Cost/Chicken	93.91	89.76	86.99	85.93	79.92
Sales					
Cost/kg Chicken	120	120	120	120	120
Total Sales/Treatment	7704.00	7656.01	7949.98	7398.00	6804.00
Total Sales/Chicken	256.8	255.20	265.00	246.60	226.80
Income/Chicken	162.89	165.44	178.01	160.67	146.88

Comparison among treatment means showed that T_4 significantly differed with all the other treatments while T_5 varied with T_1 and T_3 but not with T_2. This finding means that Treatments with higher Crude Protein levels have an effect in the conversion of feed to meat that lowered down the deposition of fat in the abdomen of the chickens.

This is in accordance with the study of Costa (2001) that abdominal fat linearly responded to dietary protein levels showing that carcass fat content decreases as feed protein levels increased. A similar result was found by Toledo (2004) who showed the effect of increasing dietary levels on carcass fat content. Leeson and Summers (1997) also found reduction in the amount of fat deposition with the increase of diet protein. Farian Filho (2003) also reported that low-protein diets increased abdominal fat deposition. Aletor *et al.* (2000) found in broilers fed diets with crude protein ranging from 21.0 to 15.3%, even when it was supplemented with non-essential amino acids (alanine, aspartic and glutamic acids) for reaching the same protein level of control diet (22.5%), higher body fat deposition than those broilers fed control diet.

According to McLeod (1997) the catabolism of amino acids have a high energy cost for the bird. High protein diets may have lower net energy content; this would explain the decreased fat deposition in the carcass of broilers.

Return above Feed Cost

The return above feed cost of broilers fed with different levels of crude protein is presented in Table 4. The cost per kilogram of feeds for the different treatments showed that Treatment 5 (17% CP) had the least cost with P18.43, followed by Treatment 4 (18% CP) with P19.04, Treatment 3 (19% CP) with P19.60, T_2 (20% CP) with P20.11 and the highest cost of feeds was attained by Treatment 5 (21% CP) with P20.64 . It is evident that the higher the Crude

Protein content of the ration, the higher will be the cost of feed production, thereby commanding a higher price per kilogram of feed.

The profitability would not rely primarily on the cost of feeds but on the growth performance of the broilers which could compensate the cost spent on feeds. In this study, results showed that Treatment 3, 19% CP recorded sales of P265.00 per chicken followed by T_1 with P256.80, T_2 with P255.20, T_4 with P246.60 and T_5 got the lowest sales of chicken with P226.88.

It can be deduced that birds fed with higher Crude Protein levels particularly 19%, 20% and 21% CP levels could generate more income because of a better gain in weight which resulted in bigger birds as compared to 18% and 17% Crude Protein levels.

With respect to income per chicken, again Treatment 3 (19%CP) got the highest income with P178.01 which is far from the income achieved by Treatment 5 with P146.88. It is clear that the best Crude Protein level that can be used to attain a good income in ranged chickens would be 19% which recorded the best feed cost and return ratio.

Conclusion

Based from the results of the study, Treatment 3 (19% CP) obtained the best result in feed conversion and return above feed cost. Treatment 1 (21% CP) had the least fat deposition in the abdomen.

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